

Disease Suppressive Composts as Substitutes For Methyl Bromide

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Agriculturalists have utilized composts for centuries to maintain plant health. Variability in success often is associated with this method of disease control because many factors affect the potential for composts to control plant diseases. The raw materials from which composts are prepared, the process and conditions under which they are produced, its maturity or stability, the microflora colonizing composts after peak heating and timing of and procedures used during utilization all have an effect. Even so, essentially all composts offer the potential to control diseases. Obviously, many factors need to be monitored to realize beneficial effects consistently.

Step one in quality control is to ensure that high temperatures (140F) prevail long enough during composting to kill pathogens and weed seeds. Windrows must be turned to expose all parts to high process temperatures for several continuous days in between turnings. Furthermore, weeds must be controlled on the site and seed should not blow onto the site to maintain a weed-free product. Composts containing weed seeds have little if any market value and represent a liability for most markets.

The second step in the process is to produce composts to a maturity or stability level optimum for the intended use. Landscape mulches need to be composted as little as one to two months. Compost utilized in field soils and applied in the fall or utilized before a green manure crop, stabilize further in the field. It is better to not stabilize such composts excessively. Composts used in potting mixes or incorporated into soil directly before planting must be stable enough to avoid low oxygen tensions there. Inadequately stabilized composts can cause phytotoxicity problems due to the production of volatile organic acids (e.g. acetic acid), ammonia or other toxic compounds. Immature composts enhance the activities of plant pathogens because of the high free nutrient concentrations. Mature composts do not cause such problems.

Beneficial microorganisms such as biocontrol agents of plant pathogens, mycorrhizae and plant growth promoting microorganisms unfortunately are almost entirely destroyed during peak heating. They naturally recolonize composts to some extent after peak heating from the lower temperature zones in compost piles (less than 100F) where they survive. Inoculation with specific biocontrol agents and mycorrhizae often is necessary to ensure consistent broad spectrum disease suppressive and plant growth promoting effects. This is particularly important for composts utilized in container media. Such inoculants are now being made available to agriculture. Some are being registered as biological pesticides.

The length of time that a compost supports these beneficial effects is determined by the quantity and composition of remaining biodegradable material. Humic substances do not support the activities of biocontrol agents. IR and NMR spectroscopy have been used to characterize the composition of this organic fraction in composts which is referred to as "biological carrying capacity". Little quantitative information is available on this topic and much remains to be discovered in this field.

Chemical and physical properties of composts have major effects on disease control and plant health. Composts high in salinity due to sodium chloride content (cow manures, etc.) must be applied months ahead of planting (3-4 mo in Ohio) to allow for leaching to avoid *Phytophthora* root rot of soybean and other plant diseases. Composts high in nitrogen content (e.g. sewage sludge and poultry manure composts) must be applied on the basis of nitrogen available to avoid increased severity of Foliar diseases such as fire blight, *Phytophthora* die-backs, etc. Finally, composted yardwastes prepared with large ratios of grass clippings can be as high as 1% in potash which also can cause high salt problems immediately after utilization if excessive quantities are applied. Each type of compost has its own characteristics that need to be considered before utilization.

Soil scientists still have difficulties predicting nutrient release properties of composts. For these and other reasons, beneficial utilization of composts still heavily relies on data obtained in demonstration trials.